



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/714,985	11/17/2003	William Hong	TS03-299	2268
7590 08/24/2004				
STEPHEN B. ACKERMAN 28 DAVIS AVENUE POUGHKEEPSIE, NY 12603			EXAMINER NGUYEN, THANH T	
			ART UNIT 2813	PAPER NUMBER

DATE MAILED: 08/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/714,985

Applicant(s)

HONG ET AL.

Examiner

Thanh T. Nguyen

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: ____.

DETAILED ACTION

Information Disclosure Statement

The information disclosure statement filed on 2/17/04 has been considered.

Oath/Declaration

Oath/Declaration filed on 1/17/03 has been considered.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

In page 1, line 4, the serial number and the filing date of the related application is missing. It is suggested to provide the above information in the next office action.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zutshi et al. (U.S. Patent No. 6,620,027) in view of Tsai et al. (U.S. Publication No. 2003/0013306).

Referring to figures 2-3, Zutshi et al. teaches an oxide polishing process of a copper layer on a substrate, said substrate has a top and bottom surface, comprising:

(a) providing a substrate (110) having a top surface comprised of a copper layer (see col. 8, lines 37-47) area which is the top of a copper layer and a dielectric layer area that is the top of a dielectric layer (see col. 8, lines 37-47);

(b) performing a first oxide polishing step at a first polish station in a polishing tool by using a polishing pad and a slurry on a platen to contact the top surface of said substrate which is held by its bottom surface on a head that has a down force and a rotational speed (see col. 9, lines 66-67, col. 10, lines 1-10);

(c) rinsing the substrate with DI water (col. 5, lines 56-67, and col. 7, lines 1-3);

(d) performing a second oxide polishing step at said first polish station by using said polishing pad and a slurry on a platen to contact the top surface of said substrate which is held by its bottom surface on a head that has a down force and a rotational speed (see col. 10, lines 32-42); and

(e) rinsing the substrate a second time with DI water ((col. 5, lines 56-67, col. 7, lines 1-3). It is noted that it would be obvious to one ordinary skill in the art to polish and clean the second oxide layer for a second time with the same process as using in the first oxide layer to form a planar oxide layer and remove the contamination since it is well-known in the art to repeat the same process for multiple effect. See *St. Regis paper, Co. V. Bemis Co. Inc.* 193 USPQ 8, 11 (7th circuit 1977)

regarding to claim 2. The method of claim 1 wherein the top of the copper layer has been polished in one or more previous cmp processes (see figure 3, col. 11, lines 27-41).

Regarding to claim 4. The method of claim 1 wherein the top surface of said substrate is further comprised of a diffusion barrier layer area at the top of a diffusion barrier layer that is comprised of TaN or one or more of Ta, Ti, TiN, WN, W, TaSiN, or TisiN and is formed between said copper layer (413) and said dielectric layer (see col. 8, lines 37-67).

Regarding to claim 10. referring to figures 2-3, Zutshi et al. teaches a chemical mechanical polish (CMP) flow sequence for polishing a substrate with a top and bottom surface during the fabrication of a copper interconnect, comprising:

(a) providing a substrate (110) having an opening (called feature, see col. 8, lines 37-47) with a top, bottom, and sidewalls formed therein, said opening is filled with a conformal diffusion barrier layer (see col. 8, lines 37-54) on the sidewalls and bottom of the opening and a copper layer (col. 9, lines 37-47) on said diffusion barrier layer wherein said diffusion barrier layer and copper layer extend above the top of said opening and the top surface of the substrate is comprised of a copper layer area at the top of the copper layer to be polished (see col. 8, lines 37-67);

(b) performing a first CMP process at a first polish station using a polishing pad and a slurry on a platen to remove a portion of the layer so that the polished copper layer becomes coplanar with said diffusion barrier layer, said substrate is held by its bottom surface on a head that has a down force and a rotational speed (see, col. 11, lines 1+).

(c) performing a second CMP process at a second polish station using a polishing pad and a slurry on a platen to remove a portion of the diffusion barrier layer and a portion of the

Art Unit: 2813

polished copper layer so that the polished diffusion barrier layer and the twice polished copper layer become coplanar with the top of the opening, said substrate is held by its bottom surface on a head that has a down force and rotational speed; (see col. 11, lines 57-67, col. 12, lines 1-50)

(d) performing a third CMP process which is an oxide polishing process at a third polishing station using a slurry and a polishing pad on a platen to form a smoother top surface comprised of a diffusion barrier area at the top of the polished diffusion barrier layer and a copper layer area at the top of the twice polished copper layer, and to remove residues from previous CMP processes, said substrate is held by a head that has a down force and a rotational speed (see col. 12, lines 51-67) and wherein said third CMP process comprises:

- (1) performing a first oxide polishing step;
- (2) rinsing the substrate with DI water;
- (3) performing a second oxide polishing step; and

(4) rinsing the substrate a second time with DI water.). It is noted that it would be obvious to one ordinary skill in the art to polish and clean the second oxide layer for a second time with the same process as using in the first oxide layer to form a planar oxide layer and remove the contamination since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977)

regarding to claim 18. The method of claim 10 wherein the first CMP process, second CMP process, and third CMP process are performed in the same CMP tool which is integrated with a spin-rinse dryer module to dry the substrate (see figure 2, cols. 5-7).

Regarding to claim 19. The method of claim 10 wherein the CMP flow sequence is implemented as pad of a damascene process and the damascene process is performed a plurality

Art Unit: 2813

of times on a substrate to fabricate a plurality of copper layers that form a stacked copper structure. It is noted that it would be obvious to one ordinary skill in the art to perform plurality CMP flow to form a plurality of copper layer since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977).

However, the reference does not teach first oxide polish step and said second oxide polishing step are performed in a CMP tool with a slurry comprised of silica, water, and one or more additives that has a pH of about 7 to 10, The temperature range, speed range, flow rate range, time range, pressure range.

Regarding to claims 3, 11. Tsai et al. teaches method of claim 1 wherein said first oxide polish step and said second oxide polishing step are performed in a CMP tool with a slurry comprised of silica, water, and one or more additives that has a pH of about 7 to 10 (see paragraphs# 41, 48-49 of Tsai et al.). About permits some tolerance. At least about 10% was held to be anticipated by a teaching of a content not to exceed about 8%. In re Ayers, 154 F2d 182, 69 U.S.P.Q. 109 (C.C.P.A. 1946). In re Erickson, 343 F 2d 778, 145 U.S.P.Q.207(C.C.P.A 1965).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would polish first oxide polish step and said second oxide polishing step are performed in a CMP tool with a slurry comprised of silica, water, and one or more additives that has a PH of about 7 to 10 in process of Zutshi et al. as taught by Tsai et al. because the process would provide a planarizing substrate surface with reduced or minimal residue.

Art Unit: 2813

The temperature range, speed range, flow rate range, time range, pressure range specifically in claims 5-9, 12-17 are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any temperature range, speed range, flow rate range, time range, pressure range suitable to the method in process of Tsai et al. in order to optimize the process.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

Art Unit: 2813

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a stylized flourish extending to the right.

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800